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(54) **BLADDER SYSTEM FOR REINFORCING A PORTION OF A LONGITUDINAL STRUCTURE**

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(56) **References Cited**

**U.S. PATENT DOCUMENTS**

1,814,677	*	7/1931	Fennema	138/93
3,054,636		9/1962	Wessells, III	
3,123,170		3/1964	Bryant	
3,493,257		2/1970	Fitzgerald et al.	
3,665,968		5/1972	DePutter	
3,746,387		7/1973	Schwenk	
3,757,559		9/1973	Welsh	
3,890,108		6/1975	Welsh	
4,019,301		4/1977	Fox	
4,029,128	*	6/1977	Yamagishi	138/93 X
4,082,825		4/1978	Puterbaugh	
4,083,384	*	4/1978	Horne et al.	138/93
4,090,734		5/1978	Inami et al.	
4,238,540		12/1980	Yates et al.	

(List continued on next page.)

**FOREIGN PATENT DOCUMENTS**

2919046	5/1979	(DE)
G9011147.8	9/1990	(DE)

4028895C1	2/1992	(DE)
G9320333.0	6/1994	(DE)
19858903A1	6/2000	(DE)
82102135.9	3/1982	(EP)
90202150.0	8/1990	(EP)
91104546.6	3/1991	(EP)
94101343.5	1/1994	(EP)
95913082.4	3/1995	(EP)
0 891 918 A1	1/1999	(EP)
0 893 331 A1	1/1999	(EP)
0 893 332 A1	1/1999	(EP)
2749263A1	5/1996	(FR)
628863	3/1947	(GB)
8028960	9/1980	(GB)
8725028	10/1987	(GB)
61118211	6/1986	(JP)
64-69308	3/1989	(JP)

(List continued on next page.)

**OTHER PUBLICATIONS**

PCT WO 99/08854 Harrison et al. Publication Date Feb. 25, 1999.\*

PCT WO 00/13958 Wycech, Publication Date Mar. 16, 2000.\*

PCT WO 99/61289 Wycech, Publication Date Dec. 2, 1999.\*

PCT WO 00/41916 Wycech, Publication Date Jul. 20, 2000.\*

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(57) **ABSTRACT**

A bladder system and method for reinforcing at least a portion of a structural member, including a flexible barrier member for dividing at least a portion of the structural member being reinforced into one or more sections; and a reinforcement material for filling one or more sections bounded by the flexible barrier member. The reinforcement material filling one or more sections of the structural member can be a pumpable polymeric material, and the flexible barrier member can be a polymeric material.

**22 Claims, 2 Drawing Sheets**

